ABSORPTION SPECTRA OF SMOKY QUARTZ FROM AN ARKANSAS VEIN DEPOSIT AND FROM A SIERRAN MIAROLITIC GRANITE

ROYAL R. MARSHALL, *California Institute of Technology, Pasadena, California.**

The absorption spectrum of a moderately colored smoky quartz crystal from the John Brown prospect in Blakely sandstone, Jessieville, Arkansas, has been determined for the wave length range 220–1000 mμ using a Beckman model DU spectrophotometer. A section 1.30 cm. thick was cut parallel to the basal pinacoid and the surfaces polished. The light path was parallel to the *c* axis. Zoning of the coloration parallel to the prism faces and also at a low angle to the (0001) plane is readily observed in the section. The measured optical densities have been corrected for small reflection losses and converted to absorption coefficient (*K*) values. The term absorption as used in this note must be qualified since a significant amount of light passing through smoky quartz is scattered (1) and the apparent absorption curve (Fig. 1) has this effect superimposed upon true absorption. *K* (in cm^{-1}) plotted against wavelength (in mμ) in Fig. 1 illustrates the continuous increase in absorption with decreasing wavelength (2, 3). There is a readily discernible shoulder on the curve at wavelengths somewhat greater than 400 mμ and a less pronounced one

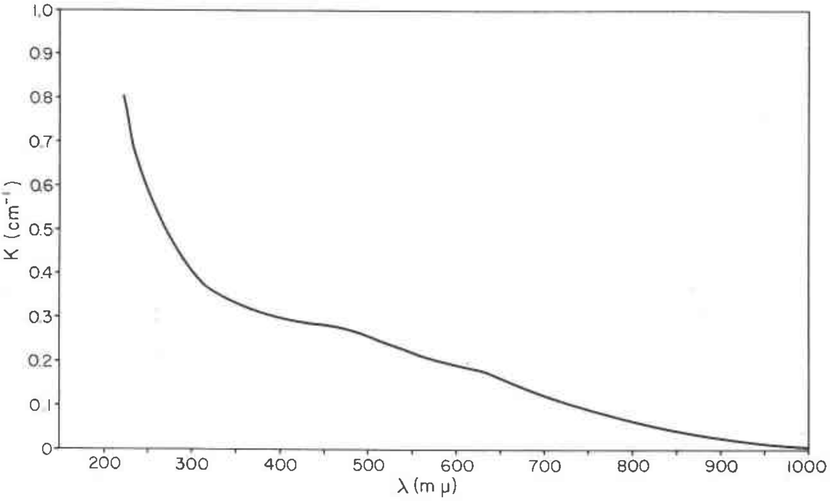

FIG. 1. Absorption coefficient versus wavelength for Arkansas smoky quartz.

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near 600 mμ. The measurements were made at 5 mμ intervals from 220 to 600 mμ and at 10 mμ intervals from 600 to 1000 mμ in a continuous run at constant temperature. The remarkably smooth curve formed by these numerous points indicates that these shoulders are significant.

Cohen (4) has studied smoky quartz from the Dinkey Lakes region, Fresno County, California, and his (5) spectrophotometric curve and confirmation of an absorption peak near 600 mμ by the photographic plate method agree with the data presented in Fig. 1. The writer has subsequently visited the Dinkey Lakes region and found that the material which Cohen used in his studies occurs in numerous miarolitic cavities typically 2 to 3 inches in diameter scattered throughout a ridge of granite. Potash feldspar and intensely colored smoky quartz crystals protrude into these cavities. Hamilton (6) has examined in detail the alaskite pluton containing these crystals.

The Arkansas specimen was obtained from a different geologic environment. This crystal formed in a quartz vein in Ordovician sandstone (the maximum age possible for the vein is middle Pennsylvanian since this and other veins cut rocks as young as middle Pennsylvanian; the minimum, lowermost Cretaceous; the inferred age is middle Pennsylvanian). Nevertheless, it exhibits the thermolabile and *x*-ray inducible coloration typical of pegmatitic smoky quartz (7). The absorption spectrum data reported in this note further substantiate the contention that there is a fundamental interpretation of the coloration of these crystals. Apparently small local concentrations of radioactive elements can darken quartz although the effects of irradiation may have to accumulate over millions of years. Some evidence (8) has appeared indicating that an impurity is required. This impurity would have to be a rather common one in view of the extensive distribution and diverse geologic environments of smoky quartz and quartz which can be artificially darkened. In accord with this is some paramagnetic resonance data suggesting that aluminum is closely connected with the magnetic centers obtained in irradiated quartz (9).

In any case it should be emphasized that the mechanism by which quartz darkens is more complicated than that generally involved in the development of the thermolabile coloration of other minerals. Mohler (3) found well-defined absorption peaks in freshly irradiated quartz which became less pronounced with time while absorption at short wavelengths increased. Also natural smoky quartz has been found to be only slightly thermoluminescent (10), an anomaly which Daniels and Saunders (11) have confirmed. However, they found that freshly irradiated quartz is very thermoluminescent. Irradiation seems to be initially accompanied by the formation of metastable electron centers. With time some reaction occurs transforming these centers to a different type (perhaps of a colloidal or light-scattering nature (1)). These centers can be annealed out in a non-radiative process.

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A NEW PARALLEL RULER FOR ADAPTING THE UNIVERSAL STAGE FOR PETROFABRIC ANALYSIS

A. W. KLEEMAN, *Mawson Laboratories,*
University of Adelaide, Adelaide, South Australia.

In adapting the universal stage for petrofabric analysis, it is necessary to fix to the upper hemisphere a parallel rule device to enable the slice to be moved into parallel positions across the field of view. (cf. Fairbairn p. 258, Fig. 20.4). Leitz has designed a special hemisphere mount with the "Schmidt Ruler" built in. In both of these devices the arm that holds the slice is parallel to the long axis of the hemisphere mount and is necessarily in contact with the shortest edge of the glass slip on which the slice is mounted. In order to cover a large area of the rock slice it is frequently necessary to change the Schmidt ruler from one end to the other of the slip, which means that the ends must be parallel.

A new type of parallel ruler in which the reference arm is at right angles to the long axis of the hemisphere mount, and hence parallel to